(12) UK Patent Application (19) GB (11) 2 340 571 (13) A

(43) Date of A Publication 23.02.2000

(21) Application No 9917713.1

(22) Date of Filing 27.07.1999

(30) Priority Data
(31) 60096583 (32) 14.08.1998 (33) US

(51) INT CL[7]
E21B 33/038 33/043 , F16L 37/00 37/12

(52) UK CL (Edition R)
F2G G33 G4J G4J7
U1S S1761

(56) Documents Cited
GB 1487948 A US 4653778 A

(58) Field of Search
UK CL (Edition Q) F2G G24A1 G33 G4J
INT CL[6] E21B 33/038 33/043 , F16L 37/00 37/02 37/08 37/084 37/12
Online: WPI, EPODOC, PAJ/O

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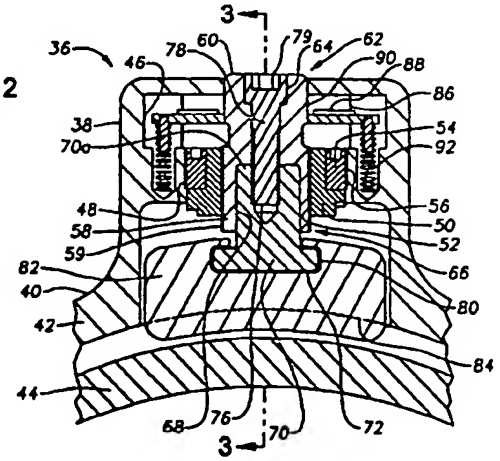
(54) Abstract Title
A connector for use in coupling pipe joints of risers

(57) A connector for connecting a box portion and a pin portion 44 of a riser comprises an actuator housing 38 affixed to the box portion 42 with a bore 48 extending through it, and an insert 50 having a set of threads 52 which is releasably secured inside the bore. The connector also includes an actuator 58 with a set of external threads 59 that engage the threads of the insert, and a flange 72 on one end of the actuator and a drive head 60 on the opposite end for rotating the actuator relative to the insert. A dog 82 having a slot interface 80 for receiving the flange of the actuator is engageable with the pin portion to affix the box portion to the pin portion. There is also provided a retainer 54 secured in the bore for releasably retaining the insert, where the retainer is releasable to allow the insert to be removed from the bore along with the actuator in the event of the threads of the insert or the threads of the actuator being damaged. The actuator may also comprise a fastener bore 64 in a first end 62 and a stem receptacle 68 in a second end 66. A threaded fastener 78 may be threadably received within the fastener bore for securing the actuator to an actuator head 70. The actuator head may comprise a stem portion 74 slidably received within the stem receptacle of the actuator, that has a threaded bore 76 for receiving the fastener. The flange portion, which receives the dog, may be located on the actuator head at the opposite end to the stem portion. The connector may be used to couple pipe joints in marine riser pipe systems for use in drilling underwater well bores.

Fig. 2



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RISER DOG SCREW WITH FAIL SAFE MECHANISM

Cross-Reference to Related Applications

This application claims the benefit of provisional application serial number 60/096,583, filed on 08/14/98, in the U.S. Patent & Trademark Office.

Prior Art

In marine riser pipe systems for use in drilling underwater well bores, pipe joints are coupled to one another by connector members. A connection is made between a pin portion of a length of pipe and a box portion of a second length of pipe. The box portion of one member is adapted to telescopically fit on the pin portion of an adjacent joint. To lock the box and pin members together to prevent axial separation, dogs may be used to engage a groove in the pin.

A typical actuator device comprises a housing welded to the box member wherein the housing includes a threaded bore. A threaded actuator screw is located in the threaded bore. The threaded actuator screw has an annular enlargement or flange on its inner end rotatably disposed in a slot of an actuator pad or dog. The actuator pad is disposed in a radial opening in the box member and has an inner face curved to conform generally to the outer periphery of the grooves on the pin. At its outer end, the actuator screw has a non-circular or hexagonal head adapted to be engaged by a driving tool or wrench so that the pad may be shifted inwardly into locking engagement in the groove of the pin member, or the pad may be shifted outwardly to allow removal of the box member from the pin member.

A difficulty encountered with the traditional actuator device is that of disengaging a defective actuator screw. If the actuator screw is prevented from being removed from the actuator housing by galling of the actuator screw threads or other difficulties, then the dog will remain in locking engagement and the pin portion and box portion of adjacent joints are difficult to disengage.

Brief Summary of Invention

Therefore, it is an object of this invention to provide a riser dog screw with a fail safe mechanism. By providing a fail safe mechanism, the operator has an additional opportunity to remove the riser dog-style connection from the joint in the event that the actuator screw becomes unremovable.

The invention includes a dog-style connector for a marine riser system that connects a box portion and a pin portion of a riser. An actuator housing is affixed to an external surface of the box portion. The actuator housing has an outer bore and a threaded inner bore. An actuator body is threadably received in the inner bore. The actuator body has a hex head on its first end. The actuator body has a threaded fastener bore extending from the first end for receiving a threaded fastener. The actuator body has a second end that has a stem receptacle formed therein. The fastener bore is in communication with the stem receptacle. An actuator head, which includes a flange and a stem, is provided wherein the stem of the actuator head is positioned within the stem receptacle of the actuator body for sliding engagement therewith. Threads formed on the threaded fastener engage a second threaded fastener bore formed in the stem of the actuator head. A dog interfaces with the flange on the actuator head and is slidably mounted with respect to the actuator body for engaging a groove in the pin portion of a riser. A threaded fastener is provided to be threadably received in the threaded fastener bore of the actuator body and the second bore of the actuator head.

In operation, the threaded fastener is placed into the fastener bore in the actuator body. The threaded fastener passes through the fastener bore and into the second bore of the actuator head. The threaded fastener secures the actuator body to the actuator head. The actuator body and the actuator head are made to fit tightly to allow the correct transfer of preload forces to the dog segment. The hex head of the actuator body is then engaged and the actuator body is threaded into the actuator housing until the dog is forced into the grooves of the pin portion of the riser.

The actuator body may become difficult or impossible to remove from the actuator housing due to reasons such as galling of the threads that engage the actuator body with an insert positioned in the actuator housing. To remove an actuator body having galled threads, the retainer ring is removed from the actuator housing, thereby allowing the actuator body and actuator head assembly to lift the dog out of engagement with the pin. The threaded fastener may be rotated by means of a hex opening to disengage the actuator body from the actuator head so that the actuator body and insert may by removed and replaced.

Brief Description of the Drawings

Figure 1 is a top cross-sectional view of a prior art dog-style connection.

Figure 2 is a top cross-sectional view of a dog-style connection of the invention.

Figure 3 is a side cross-sectional view of a dog-style connection of the invention, taken along the line 3-3 of Figure 2.

Figure 4a is an enlarged partial elevational view and partial cross-sectional view of a first or polygonal embodiment of a riser dog actuator that is part of the dog-style connection of Figure 2.

Figure 4b is an enlarged partial elevational view and partial cross-sectional view of an alternate or eccentric embodiment of a riser dog actuator that is part of the dog-style connection of Figure 2.

Figure 5a is a perspective view of the actuator head having a polygonal stem that is shown in Figure 4a.

Figure 5b is a perspective view of the actuator head having an eccentric stem that is shown in Figure 5b.

Figure 6 is a perspective view of the riser dog actuator of Figures 4 and 5.

Figure 7 is an end view of the riser dog actuator of Figures 4 and 5.

Detailed Description of the Invention

Figure 1 shows a prior art dog connection 10. The dog connection 10 includes an actuator housing 12 that is affixed to an external surface 14 of a box portion 16 of a riser. The dog connection 10 connects box portion 16 with pin portion 18 of a riser.

An outer bore 20 is formed in the actuator housing 12. A threaded inner bore 22 is also formed in the actuator housing 12. An actuator screw 24 is threaded into inner bore 22. The actuator screw 24 has a hex head 26 that may be engaged by a socket or other device for inserting or removing actuator screw 24. On an opposite end of actuator screw 24 is actuator head 28. Actuator head 28 is inserted into an interface 30, preferably a T-slot interface formed in dog 32. Dog 32 is retracted or extended into recess 34 in pin portion 18. By extending dog 32 into recess 34, box portion 16 is affixed to pin portion 18.

A difficulty encountered with use of the prior art dog connection is that when the actuator screw 24 cannot be removed, then the box portion 16 and pin portion 18 may not be disengaged.

An improved dog connection 36 is provided (Figs. 2-7). Dog connection 36 includes an actuator housing 38, which is affixed to an external surface 40 of box portion 42. The dog connection 36 connects box portion 42 with pin portion 44. Actuator housing 38 is provided with an outer bore 46 and a threaded inner bore 48. Insert 50 is positioned within inner bore 48. Insert 50 has internal threads 52 provided thereon. Insert 50 is affixed to actuator housing 38 by retainer ring 54. Retainer ring 54 has external threads that engage the threads of inner bore 48. Retainer ring 54 also has spaced apart drive holes 55 for being engaged by a tool. Retainer ring 54 has external threads 56 that engage the threaded surface of inner bore 48.

An actuator body 58 and actuator stem 70 are located within the actuator housing 38. A polygonal embodiment (Figure 4a) and an eccentric embodiment (Figure 4b) of actuator body 58 and actuator stem 70 (Figures 5a and 5b) are discussed below. Similar components are designated by the same numerals. Differing components are designated by the addition of an "a" or "b" following the corresponding numerals. Although an "a" or "b" distinguishes the components of the different embodiments in Figures 4a, 4b, 5a and 5b, the components are generically referenced in Figures 2, 3, 6 and 7 without the letter designations.

Referring now to Figure 4a, the preferred, or polygonal actuator body 58a is shown. Actuator body 58a may be threaded into internal threads 52 of insert 50. Actuator body 58a has external threads 59. Actuator body 58a is provided with a hex drive head 60, which is for receiving a socket wrench or other device. Hex head 60 is formed on first end 62 of actuator body 58a. A fastener bore 64 is formed in first end 62. Actuator body 58a has a second end 66, which has a polygonal stem receptacle 68a therein. Polygonal stem receptacle 68a is smooth, i.e., is not a threaded receptacle.

An actuator head 70a (Figures 4a and 5a) is provided for sliding engagement with polygonal stem receptacle 68a. Actuator head 70a has a flange 72 on one end and a polygonal actuator stem 74a on another end. Preferably, polygonal shaped stem receptacle 68a and actuator stem 74a is hexagonal in cross-section. However, other

configurations may be used to prevent relative rotation of actuator body 58a and actuator head 70a. Polygonal actuator stem 74a slidably engages polygonal stem receptacle 68a. A threaded fastener 78 is received in fastener bore 64 of actuator body 58a and threads into second fastener bore 76. Threaded fastener 78 has a hexagonal recess 79 for receiving a tool therein. Fastener bore 76 is threaded, therefore threaded fastener 78 secures actuator body 58a and actuator head 70a together. The head of threaded fastener 78 is enlarged and fits within a center bore in fastener bore 64 to secure actuator body 58a to actuator head 70a. Flange 72 of actuator head 70a engages a T-slot interface 80 of dog 82 (Figures 2 and 3). Actuator head 70a may be retracted or extended away from or towards grooves 84 in pin portion 44, thereby moving dog 82 for either locking together or releasing box portion 16 and pin portion 18.

Referring now to Figure 4b, an alternate, or eccentric actuator body 58b is shown. An actuator body 58b may be threaded into internal threads 52 of insert 50. Actuator body 58b has external threads 59. Actuator body 58b is provided with a hex drive head 60, which is for receiving a socket wrench or other device. Hex head 60 is formed on first end 62 of actuator body 58b. A fastener bore 64 is formed in first end 62. Actuator body 58b has a second end 66, which has a stem receptacle 68b therein. Stem receptacle 68b is smooth, i.e., is not a threaded receptacle.

An actuator head 70b (Figures 4b and 5b) is provided for sliding engagement with stem receptacle 68b. Actuator head 70b has a flange 72 on one end and an actuator stem 74b on another end. Actuator stem 74b slidably engages stem receptacle 68b. An eccentric fastener bore 76 passes into stem 74b of actuator head 70b. The axis of fastener bore 76 is offset from the axis of actuator head 70b. A threaded fastener 78 is received in fastener bore 64 of actuator body 58b and threads into second or eccentric fastener bore 76. Threaded fastener 78 has a hexagonal recess 79 for receiving a tool therein. Fastener bore 76 is threaded, therefore threaded fastener 78 secures actuator body 58b and actuator head 70b together. The head of threaded fastener 78 is enlarged and fits within a center bore in fastener bore 64 to secure actuator body 58b to actuator head 70b. Flange 72 of actuator head 70b engages a T-slot interface 80 of dog 82. (Figures 2 and 3) Actuator head 70b may be retracted or extended away from or towards grooves 84 in pin portion

44, thereby moving dog 82 for either locking together or releasing box portion 16 and pin portion 18.

Referring back to Figure 1, radial slots 86 are formed within outer bore 46 of actuator housing 38. A lock plate 88 is retractably positioned within outer bore 46. Lock plate 88 has a hexagonal orifice 90 that compliments hex head 60 of actuator body 58. Springs 92 are provided to position lock plate 88 around hex head 60. Therefore, hexagonal orifice 90 prevents actuator body 58 from backing out of actuator housing 38 by vibration or other reasons.

In operation, threaded fastener 78 is placed into fastener bore 64 of actuator body 58 and threaded into fastener bore 76 of actuator head 70 by inserting a tool in hexagonal opening 79. Actuator body 58 and attached actuator head 70 are then positioned within the actuator housing 38. Flange 72 of actuator head 70 is engaged with T-slot interface 80 of dog 82. As actuator body 58 is threaded into internal threads 52 of insert 50 in actuator housing 38, dog 82 is extended towards groove 84 in pin portion 44. Once dog 82 bottoms out within groove 84, box portion 42 and pin portion 44 are locked together. Lock plate 88 is then allowed to spring into position around the hex head 60 of actuator body 58.

To unlock box portion 42 from pin portion 44, lock plate 88 is pressed inward to disengage it from hex head 60. A wrench engages hex head 60 to cause actuator body 58 to back out of internal threads 52 of insert 50 in actuator housing 38. This causes dog 82 to retract. Threaded fastener 78 will not unscrew from actuator head 70 while hex head 60 is being rotated because threaded fastener 78 is eccentric to actuator body 58.

If the internal threads 52 of insert 50 or external threads of actuator body 58 become galled thereby preventing actuator body 58 from being removed from actuator housing 38, then retainer ring 54 will be removed, thereby freeing insert 50 and actuator body 58. Insert 50 and actuator body 58 may then be retracted, thereby retracting dog 62 from groove 84. After retraction of dog 62, box portion 16 and pin portion 18 may be separated. Threaded fastener 78 is then removed, thereby disengaging actuator body 58 and actuator head 70. After separation and after threaded fastener 78 is removed, actuator body 58, insert 50, and retainer ring 54 may be removed and replaced.

This invention has significant advantages including allowing a frozen actuator body and retainer ring to be removed and replaced rather than having to cut the actuator body for removal.

In the claims:

1. A connector for connecting a box portion and a pin portion of a riser comprising:

an actuator housing affixed to the box portion and having a bore extending therethrough;

an insert containing a set of threads and releasably secured inside the bore;

an actuator having a set of external threads that engage the threads of the insert, said actuator having a flange on one end and a drive head on an opposite end for rotating the actuator relative to the insert;

a dog having a slot interface for receiving said flange, said dog for engaging the pin portion to affix the box portion to the pin portion; and

a retainer secured in the bore for releasably retaining the insert, the retainer being releasable to allow the insert to be removed from the bore along with the actuator in the event the threads of the insert or the threads of the actuator become damaged.

2. The connector according to claim 1 wherein:

said actuator comprises an actuator body, an actuator stem, and a threaded fastener.

3. The connector according to claim 1 wherein:

said retainer has threads on an outside diameter that engage threads in the bore of said actuator housing.

4. The connector according to claim 1 wherein:

said retainer has threads on an outside diameter that engage threads in the bore of said actuator housing and a flange for insertion within said slot interface of said dog.

5. The connector according to claim 1 wherein:

said actuator comprises an actuator body, an actuator stem that is eccentrically offset from an axis of said actuator body, and a threaded fastener.

6. The connector according to claim 1 wherein:

said actuator comprises an actuator body, an actuator stem that is polygonal in cross-section, and a threaded fastener.

7. The connector according to claim 1 wherein:

said drive head of said actuator body is polygonal.

8. A connector for connecting a box portion and a pin portion of a riser comprising:

an actuator housing affixed to the box portion;

a bore extending through said actuator housing;

an actuator body threadably received within said bore, said actuator body having a fastener bore in a first end and a stem receptacle in a second end;

an actuator head comprised of a stem portion and a flange portion, said stem portion slidably received within said stem receptacle of said actuator body, said actuator head having a threaded head fastener bore on an end of said stem portion opposite said flange portion;

a threaded fastener threadably received within said actuator body fastener bore and extending within said head fastener bore for securing said actuator body to said actuator head; and

a dog having a slot interface for receiving said flange portion, said dog for engaging the pin portion to affix the box portion to the pin portion.

9. The connector according to claim 8 further comprising:

an insert within said bore of said actuator housing, having a threaded insert bore that threadingly receives said actuator body; and

a retainer secured in the actuator housing bore for releasably retaining the insert, the retainer being releasable to allow the insert to be removed from the bore along with the actuator body in the event the threads of the insert or the threads of the actuator body become damaged.

10. The connector according to claim 8 further comprising:

an insert within said bore of said actuator housing, having a threaded insert bore that threadingly receives said actuator body;

a retainer secured in the bore of said actuator housing for releasably retaining the insert, the retainer being releasable to allow the insert to be removed from the actuator housing bore along with the actuator body in the event the threads of the insert or the threads of the actuator body become damaged; and

wherein said retainer is secured in the bore of the actuator housing for releasably retaining the insert, the retainer being releasable to allow the insert to be removed from the bore along with the actuator body in the event the threads of the insert or the threads of the actuator body become damaged.

11. The connector according to claim 8, wherein said threaded fastener has an offset axis with respect to said actuator body.

12. A connector for connecting a box portion and a pin portion of a riser comprising:

an actuator housing affixed to the box portion;

a bore extending through said actuator housing;

an actuator body threadably received within said bore, said actuator body having a fastener bore in a first end and a stem receptacle in a second end;

an actuator head comprised of a stem portion and a flange portion, said stem portion slidably received within said stem receptacle of said actuator body, said actuator

head having a threaded head fastener bore on an end of said stem portion opposite said flange portion;

an insert within said bore of said actuator housing, said insert having a threaded insert bore that threadingly receives said actuator body;

a threaded fastener threadably received within said actuator body fastener bore and extending within said actuating head fastener bore for securing said actuator body to said actuator head;

a dog having a slot interface for receiving said flange portion, said dog for engaging the pin portion to affix the box portion to the pin portion; and

a retainer secured in the bore for releasably retaining the insert, the retainer being releasable to allow the insert to be removed from the bore along with the actuating body in the event the threads of the insert or the threads of the actuator body become damaged.

13. The connector according to claim 12, wherein said threaded fastener has an offset axis with respect to said actuator body.

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Application No:	GB 9917713.1	Examiner:	Gareth Prothero
Claims searched:	1 to 7, and 12	**Date of search:**	17 November 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): F2G (G4J, G24A1, G33)

Int Cl (Ed.6): E21B 33/038, 33/043; F16L 37/00, 37/02, 37/08, 37/084, 37/12

Other: Online: WPI, EPODOC, PAJIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 1487948 A (HUNTING) see fig 1.	
A	US 4653778 A (ALANDY) see figs 5 and 6.	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Fig. 1
(Prior Art)

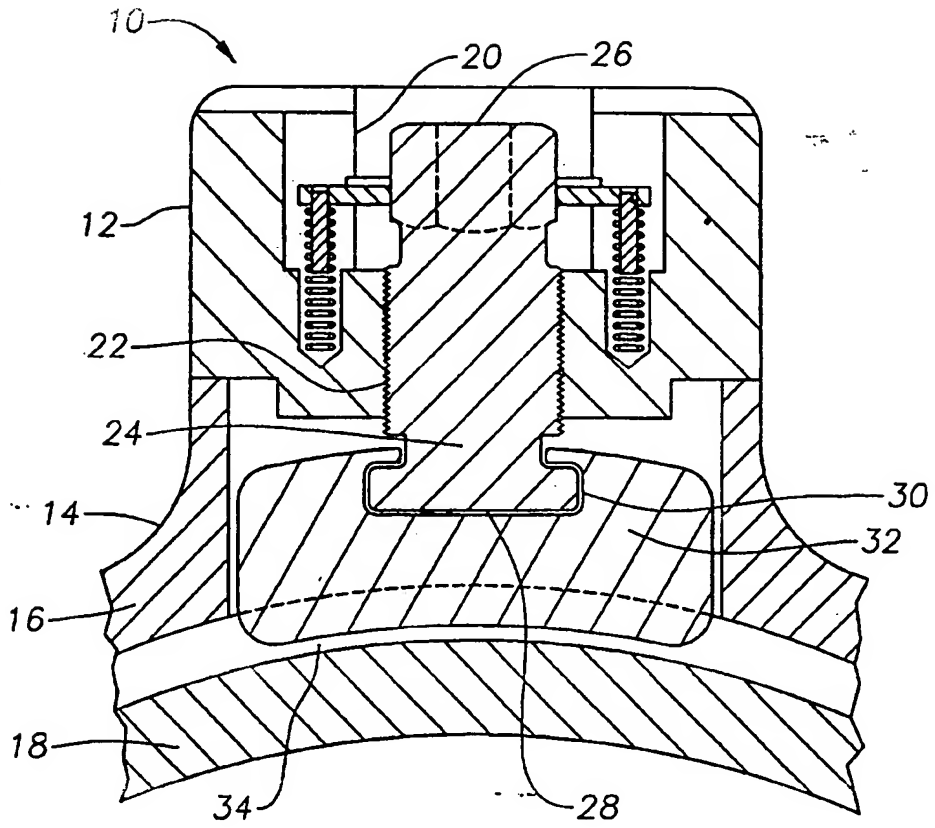


Fig. 2

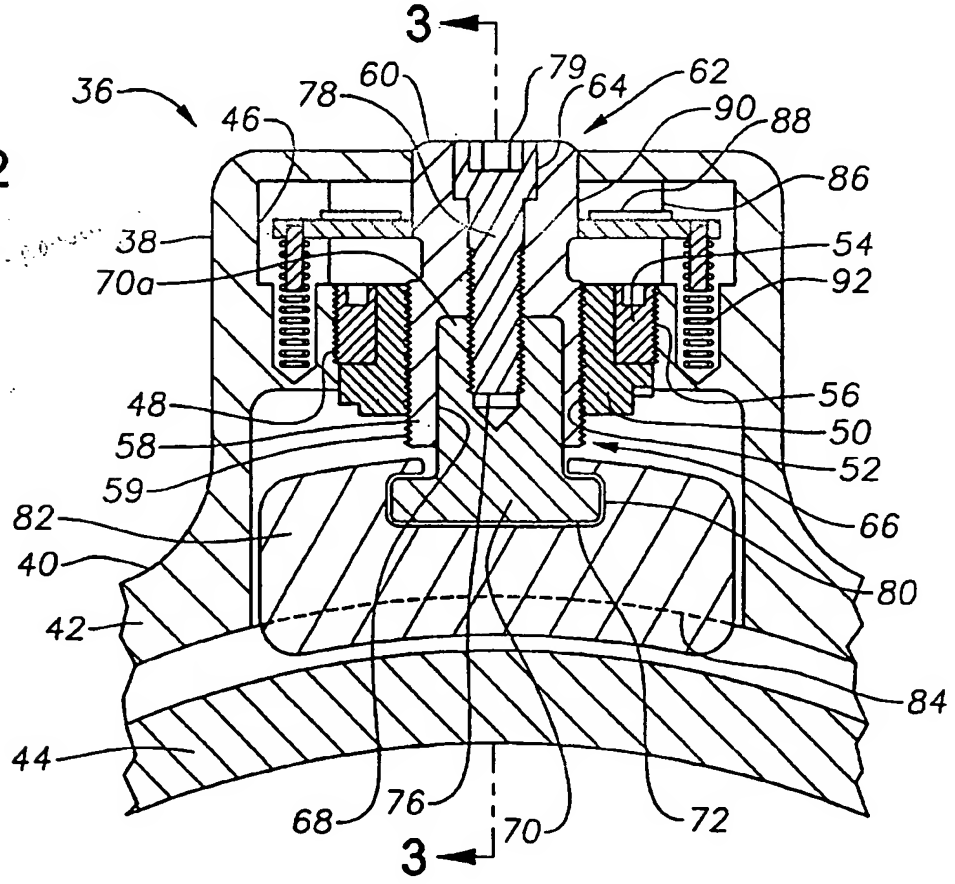
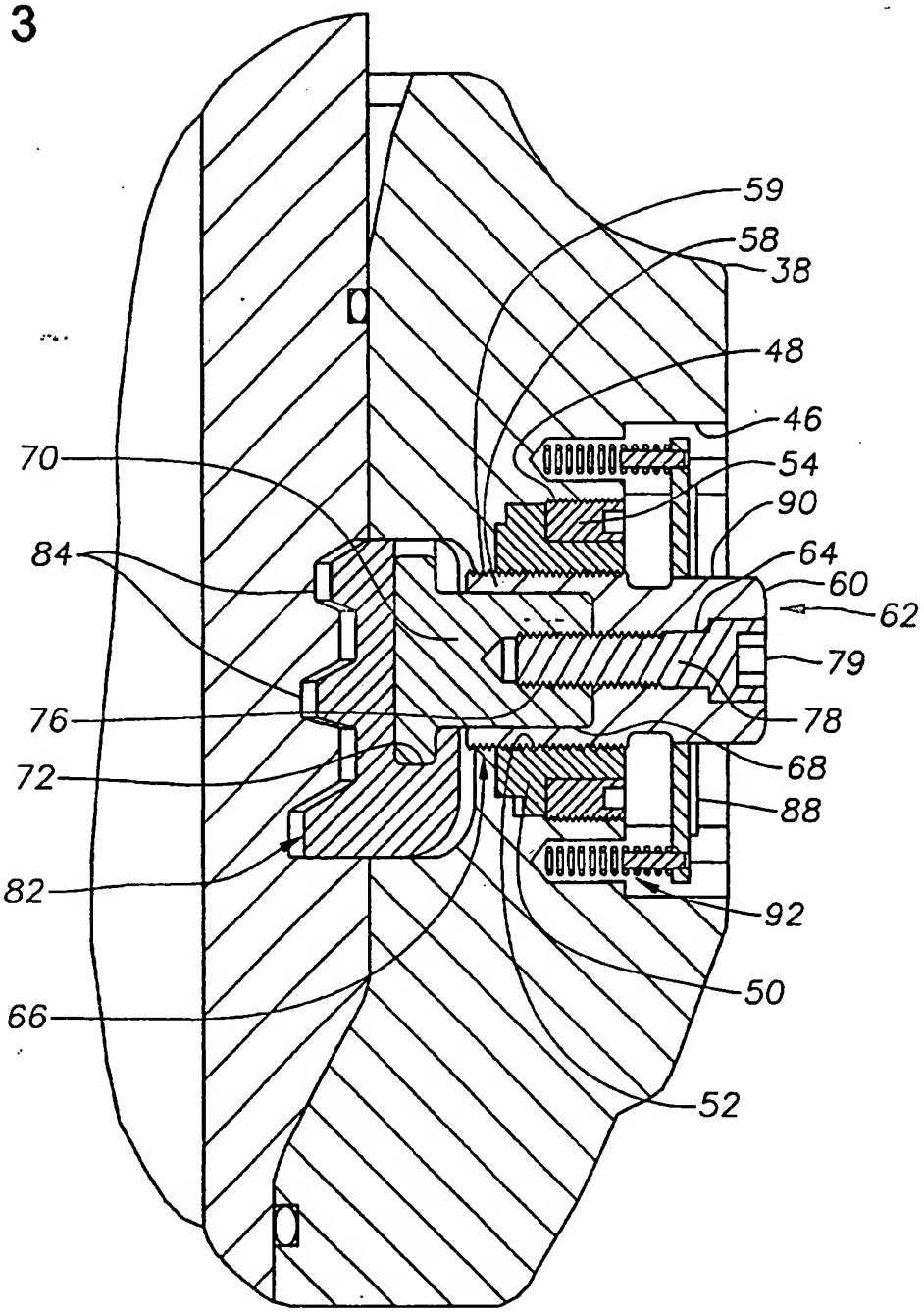


Fig. 3



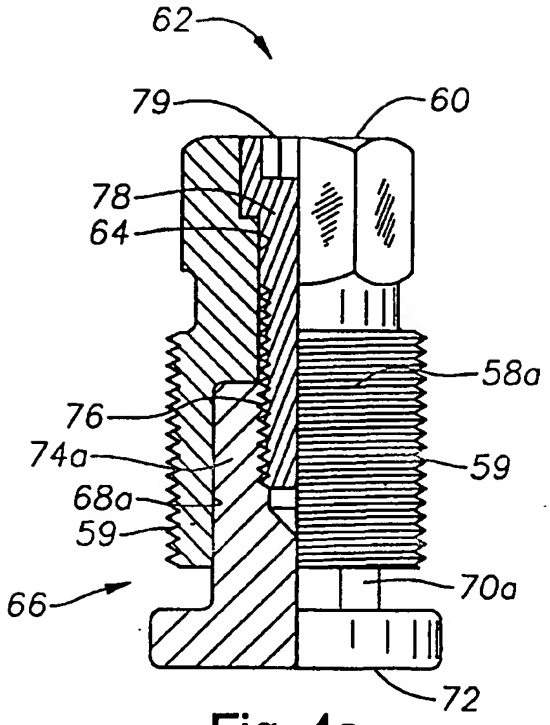


Fig. 4a

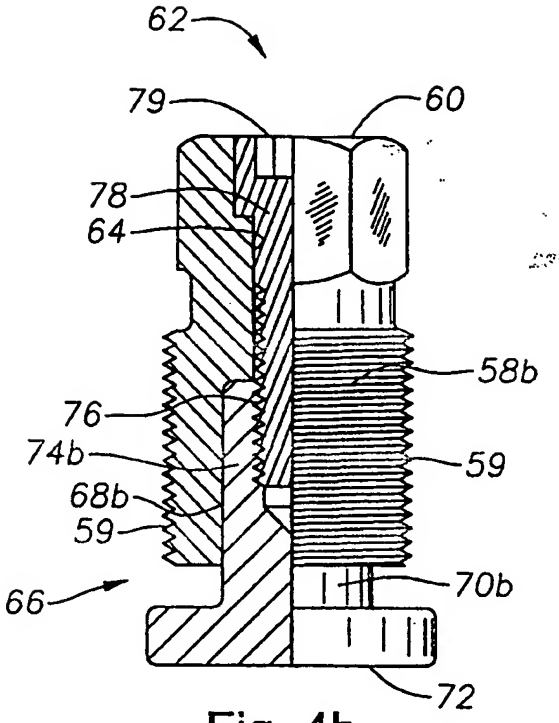


Fig. 4b

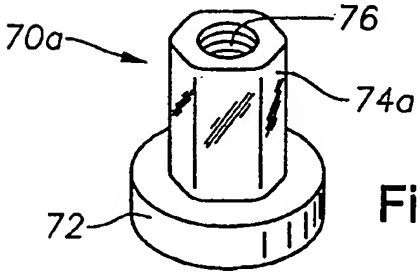


Fig. 5a

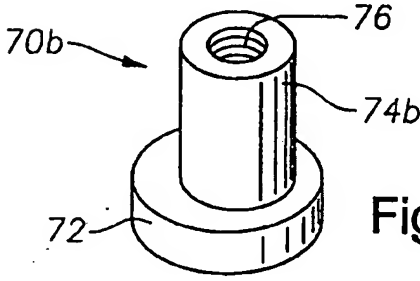


Fig. 5b

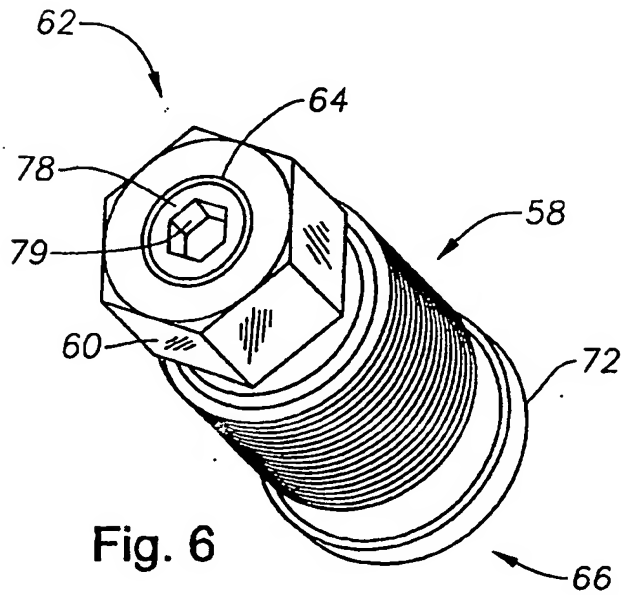


Fig. 6

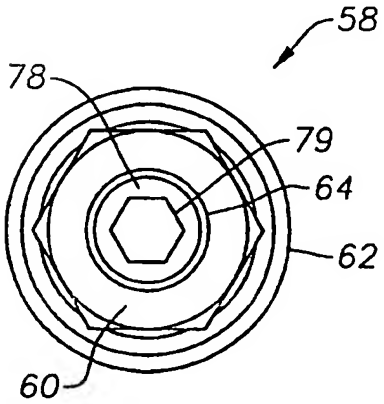


Fig. 7

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 405 951 A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 90307043.1

(22) Date of filing: 27.06.90

(51) Int. Cl.5: E21B 17/08, E21B 33/038, F16L 25/00, F16L 37/00

(30) Priority: 29.06.89 GB 8914931

(43) Date of publication of application: 02.01.91 Bulletin 91/01

(84) Designated Contracting States: FR GB IT

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(54) A releasable connector.

(57) A releasable connector (3) is described for connecting a first member (2) to a second member (1), the members (1, 2) being adapted to be inserted into one another. The releasable connector (3) comprises a lock element (4) located in a recess (5) in a surface of the first member (2) and biasing means is provided to bias the lock element (4) to a first position in which the lock element (4) extends from the recess (5) to engage a shoulder on the second member (1) to lock the first member (2) to the second member (1) against withdrawal. A movable release device (7) is located on the second member (1) so that actuation of the release device (7) causes the release device (7) to co-operate with a surface (9) of the lock element (4) to move the lock element (4) to a second position against the action of the biasing means. This causes the lock element (4) to be disengaged from the shoulder on the second member (1) with the release device (4) terminating short of the recess (5) in the first member (2). The arrangement is such that during withdrawal of the members (1, 2) from each other the lock element (4) moves to a third position in which the lock element (4) is further into the recess (5) than in the second position.

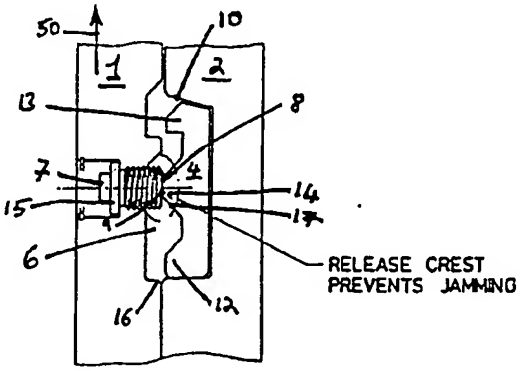

Figure 3B

EP 0 405 951 A1

A RELEASABLE CONNECTOR

The invention relates to releasable connectors and, in particular, connectors for releasably connecting sections of pipe.

Stab type connectors are extensively used in offshore drilling applications. This type of connector is used to connect sections of pipe together as they are lowered into a pre-drilled hole. The connectors are also used where pipe is driven into the ground. Extensive use is made of stab type connectors in offshore drilling, however other applications include onshore drilling operations, pipeline technology and all other applications where quick connections of sections of pipe are required.

One of the features of stab type connectors is their ability to release should the user require to dismantle long pipe sections. In particular, the ability to rapidly achieve disconnection of long pipe sections on site on the oilfield can save a considerable amount of time, thus resulting in lower cost operations.

Many of the conventional stab type connectors comprise a lock ring housed on the pin section of a pipe which expands into a groove on the box end of a second pipe to which the first pipe is to be connected in order to lock the two pipes together. To release the connector this lock ring is depressed with a set of radial bolts located in the box section of the second pipe. These conventional stab type connectors present the risk of jamming the connector while trying to release it. This may be for example by the release bolts gripping the pin section of the first pipe or by the release bolts becoming trapped in the groove which locates the locking ring on the first pipe.

In accordance with the present invention, a releasable connector for connecting a first member to a second member, the members being adapted to be inserted one within the other, comprises a lock element located in a recess in a surface of the first member; biasing means to bias the lock element to a first position in which the lock element extends from the recess to engage a shoulder on the second member to lock the first member to the second member against withdrawal; and a movable release device located on the second member whereby actuation of the release device causes the release device to cooperate with a surface of the lock element to move the lock element to a second position, against the action of the biasing means, in which the lock element is disengaged from the shoulder on the second member with the release device terminating short of the recesss in the first member, the arrangement being such that during withdrawal of the members one from the other the lock element moves to a third position in which the lock element is further into the recess than in the second position.

By providing a releasable connector which comprises a release device which terminates short of the recess in the first member after the release device has been actuated mitigates the problems associated with conventional connectors.

In one example the release device comprises a bolt and is actuated by screwing the bolt through the second member so that an end of the bolt co-operates with the surface of the lock element. In a second example the release device may comprise a fluid actuated piston within the second member which upon actuation by the fluid is forced to co-operate with the surface of the lock element.

Preferably, the release device comprises a stop element which prevents the release device from entering the recess in the first member.

In the preferred embodiment, the lock element comprises a number of projections which co-operate with at least one recess in the second member. Preferably, the surface of one projection provides the cooperating surface of the lock element and in the preferred embodiment this projection is the only projection which remains outwith the recess in the first member after actuation of the release device. Typically, the sides of the projection which provide the cooperating surface are at an angle of substantially 45 degrees to the direction of relative movement between the first and second members when they are withdrawn one from the other.

In the preferred embodiment the lock element comprises three projections mutually spaced in the direction of withdrawal of the first and second members and, typically, the co-operating surface is provided by the central projection.

In the preferred embodiment, the recesses are provided by circumferential grooves in the first member and the second member and the recesses are located adjacent to each other when the first member is connected to the second member. Typically, the lock element is a split ring which is located in the circumferential groove of the first member and preferably, the split ring acts as the biasing means.

Two examples of a releasable connector will now be compared and contrasted with two prior art releasable connectors with reference to the accompanying drawings, in which:-

Figs. 1A and 1B show a first example of a prior art connector and its method of operation;

Figs. 2A and 2B show a second example of a prior art connector and its method of operation;

Figs. 3A and 3B show a first example of a

releasable connector according to the invention and its method of operation;

Fig. 4 shows in detail a second example of a releasable connector according to the invention; and,

Fig. 5 shows in more detail the connector shown in Figs. 3A and 3B.

Fig. 1 shows two sections of pipe 1, 2 and a releasable connector 3 connecting the two sections of pipe 1, 2.

The releasable connector 3 comprises a locking ring 4 which is located in the circumferential groove 5 in the pipe section 2 and is biased by a biasing means (not shown) to the position shown in Fig. 1A where the locking ring 4 engages a recess 6 in the pipe section 1. The releasable connector 3 also comprises a release bolt 7 which passes through the wall of the pipe section 1 so that the end 8 of the release bolt 7 co-operates with a surface 9 on the locking ring 4.

In order to release the pipe section 1 from the pipe section 2, the release bolt 7 is screwed into the pipe section 1 so that the end 8 of the release bolt 7 acts on the surface 9 of the locking member 4 to force the locking member 4 into the position shown in Fig. 1B where it is completely within the recess 5.

The problem with this type of connector is that due to manufacturing tolerances the release bolt 7 may actually enter the recess 5 in the pipe section 2. This means that when an attempt is made to disconnect the pipe sections 1, 2 the release bolt 7 is trapped by the side wall 10 of the recess 5 in the pipe section 2.

Figs. 2A and 2B show a second example of a releasable connector 3 according to the prior art. The method of operation is similar to the method of operation of the releasable connector 3 shown in Figs. 1A and 1B. However, in this case the release bolt 7 is screwed into the recess 6 to force the locking ring 4 into the recess 5 in the pipe section 2, and the end 8 of the release bolt 7 is forced against the side wall 11 of the pipe section 2. Hence, the release bolt 7 grips the pipe section 2 and prevents the pipe section 1 from being disconnected from the pipe section 2.

As described above, both the prior art releasable connectors may inadvertently prevent pipe sections from being disconnected from each other due to manufacturing tolerances present in the connector. This can produce costly delays when large numbers of pipe sections have to be disconnected on site at an oilfield.

Figs. 3A and 3B show a first example of a releasable connector which overcomes these problems. As with Figs. 1A to 2B there are two sections of pipe 1, 2. Each pipe section 1, 2 has a respective circumferential groove 6, 5 and a locking ring 4 is located in the circumferential groove 5 in the pipe section 2. The locking ring 4 has two lock shoulders 12, 13, and a release crest 14 located on its external circumferential surface. The outer diameter of the surface 8 of the release crest 14 is greater than the outer diameter of the lock shoulders 12, 13.

The releasable connector 3 also comprises a release bolt 7 and the end 8 of the release bolt 7 co-operates with the outer surface 9 of the release crest 14. The release bolt 7 also has a stop ring 15 which limits the axial movement of the release bolt 7 to prevent the end 8 of the release bolt 7 entering the groove 5 in the pipe section 2 which would result in the end of the release bolt 7 becoming trapped by the side wall 10 of the groove 5 when an attempt is made to disconnect the pipe sections 1, 2.

As shown in Fig. 3B, in order to disconnect the pipe sections 1, 2 from each other the release bolt 7 is screwed into the groove 6 until it is stopped by the stop ring 15. This causes the lock ring 4 to be pushed against the action of its natural resilience into the groove 5. The location of the stop ring 15, the length of the release bolt 7 from the stop ring 15 to its end 8 and the outer diameters of the release crest 14 and lock shoulders 12, 13 are all chosen so that when the release bolt 7 is screwed into the groove 6 until it is stopped by the stop ring 15, the lock shoulders 12, 13 are completely withdrawn from the groove 6 but the release crest 14 still protrudes into the groove 6.

When this position has been achieved the pipe section 1 may be moved relative to the pipe section 2 in the direction of the arrow 50 so that the corner 16 of the pipe section 1 strikes the side 17 of the release crest 14. The sides 17, 18 of the release crest 14 are both at an angle of approximately 45° to the direction of relative movement of the pipe sections 1, 2. Hence, when the corner 16 of the pipe section 1 strikes the side 17 of the release crest 14 the lock ring 4 is forced further into the groove 5. The corner 16 slides along the surface 17 until the release crest 14 is completely withdrawn from the groove 6 at which point the pipe section 1 may be completely removed from the pipe section 2.

Fig. 4 shows an alternative example of the invention in which the release bolts 7 are actuated by a hydraulic system (not shown) which forces fluid through the passages 20 and against an end surface 21 of the release bolt 7. Except for the use of a hydraulic system to actuate the release bolt 7, this example of the invention works in a similar manner to that described above for Figs. 3A and 3B. Fig. 4 also shows an anti-rotation pin 22 which is fixed to the pipe section 2 and co-operates with a slot 23 in the pipe section 1 to prevent rotation of

the pipe section 1 relative to the pipe section 2. The anti-rotation pin 22 and an anti-rotation pin (not shown) which prevents relative rotation between the locking ring 4 and the pipe section 2 ensure that the release bolt 7 is always correctly aligned with the release crest 14 of the lock ring 4.

The pipe section 2 also has two O-rings 24, 25 located in it and these prevent fluid flowing within the pipes from escaping through the joint where the two pipe sections 1, 2 are connected. The O-rings 24, 25 also prevent leakage of a fluid within pipes, from the pipes at the point of connection.

Fig. 5 is similar to Fig. 4 but shows the use of the releasable connector shown in Figs. 3A and 3B in place of the hydraulic connector shown in Fig. 4.

The use of a releasable connector as shown in Figs. 3A and 3B, 4 and 5 mitigates the problems of the prior art apparatus by helping to prevent the release bolt 7 from being inserted too far and by enabling relative movement of the two pipe sections to be achieved while the release crest 14 of the lock ring 4 is still within the groove 6 in the pipe section 1.

Modifications and improvements may be incorporated without departing from the scope of the invention.

Claims

1. A releasable connector for connecting a first member (2) to a second member (1), the members (1, 2) being adapted to be inserted one within the other, comprising a lock element (4) located in a recess (5) in a surface of the first member (2); biasing means to bias the lock element (4) to a first position in which the lock element (4) extends from the recess (5) to engage a shoulder on the second member (1) to lock the first member (2) to the second member (1) against withdrawal; and a movable release device (7) located on the second member (1) whereby actuation of the release device (7) causes the release device (7) to co-operate with a surface (9) of the lock element (4) to move the lock element (4) to a second position, against the action of the biasing means, in which the lock element (4) is disengaged from the shoulder on the second member (1) with the release device (7) terminating short of the recess (5) in the first member (2), the arrangement being such that during withdrawal of the members (1, 2) one from the other the lock element (4) moves to a third position in which the lock element (4) is further into the recess (5) than in the second position.

2. A releasable connector according to Claim 1, wherein the release device (7) comprises a bolt and is actuated by screwing the bolt through the second member (1) so that an end (8) of the bolt co-operates with the surface (9) of the lock element (4).

3. A releasable connector according to Claim 1, wherein the release device (7) comprises a fluid actuated piston within the second member (1) which upon actuation by the fluid is forced to co-operate with the surface (9) of the lock element (4).

4. A releasable connector according to any of the preceding Claims, wherein the release device (7) comprises a stop element (15) which prevents the release device (7) from entering the recess (5) in the first member (2).

5. A releasable connector according to any of the preceding Claims, wherein the lock element (4) comprises a number of projections (12, 13, 14) which co-operate with at least one recess (6) in the second member (1).

6. A releasable connector according to Claim 5, wherein the surface (9) of one projection (14) provides the co-operating surface of the lock element (4).

7. A releasable connector according to Claim 6, wherein the one projection (14) is the only projection which remains outwith the recess (5) in the first member (2) when the lock element (4) is in the second position.

8. A releasable connector according to Claims 5 to 7, wherein the lock element (4) comprises three projections (12, 13, 14) mutually spaced in the direction of withdrawal of the first and second members (1, 2).

9. A releasable connector according to any of Claims 5 to 8, wherein the recesses (5, 6) are provided by circumferential grooves in the first member (2) and the second member (1) and the recesses (5, 6) are located adjacent to each other when the first member (2) is connected to the second member (1).

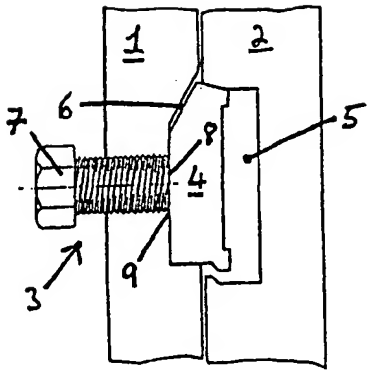

Figure 1A

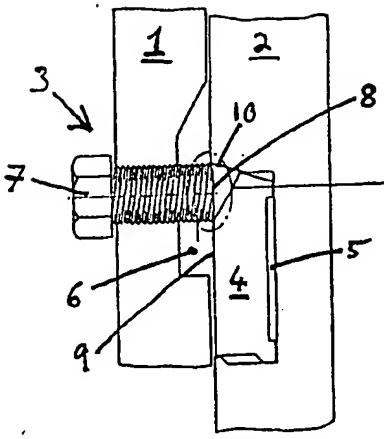

Figure 1B

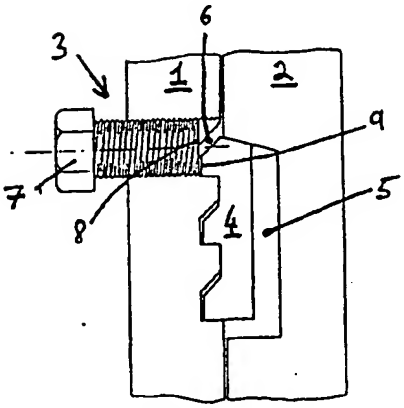

Figure 2A

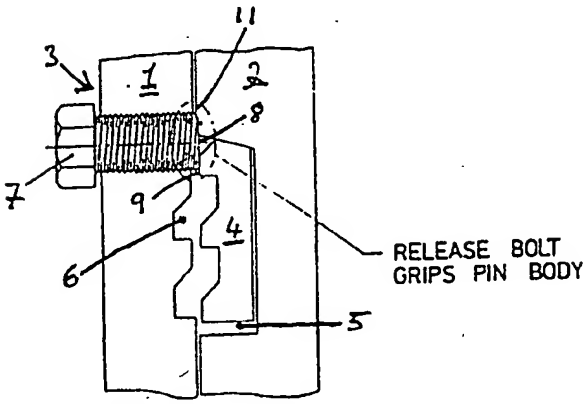

Figure 2B

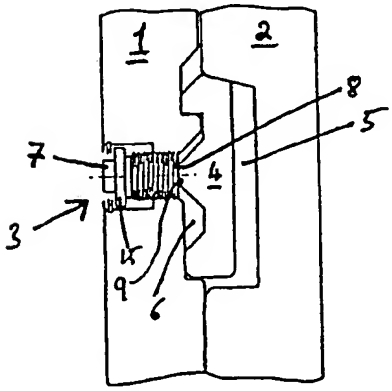

Figure 3A

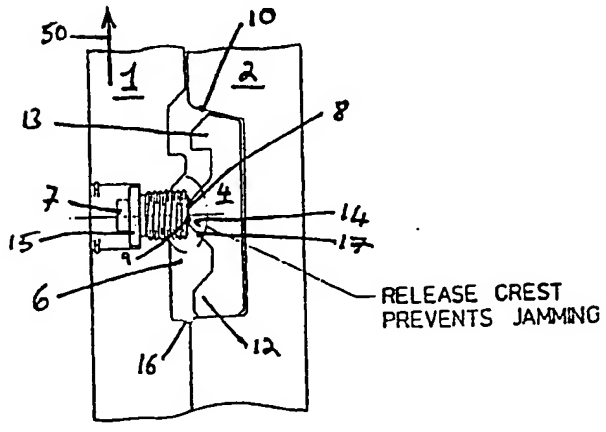

Figure 3B

HYDRAULIC SYSTEM

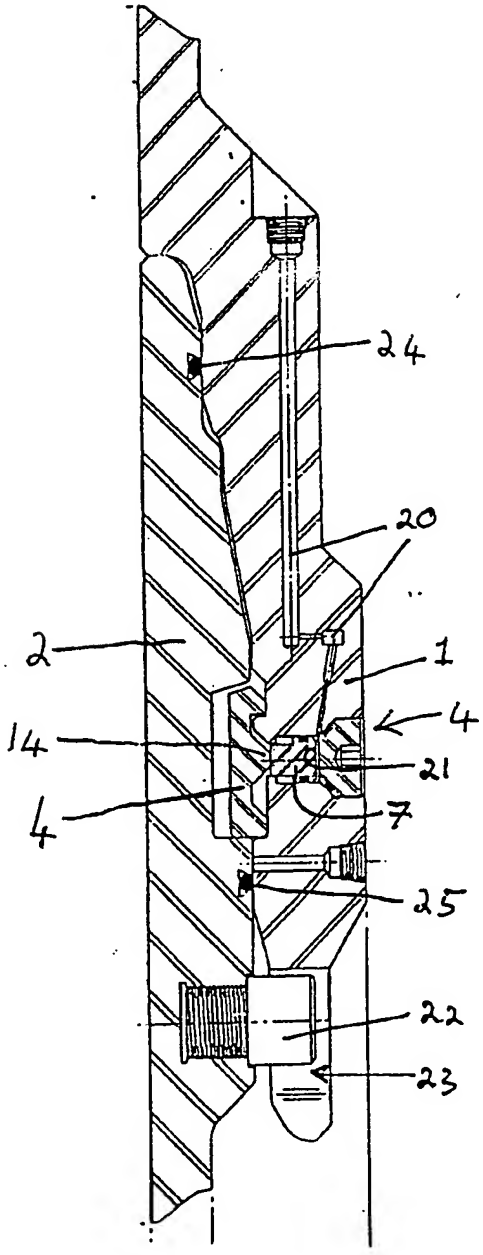

Figure 4

MANUAL SYSTEM

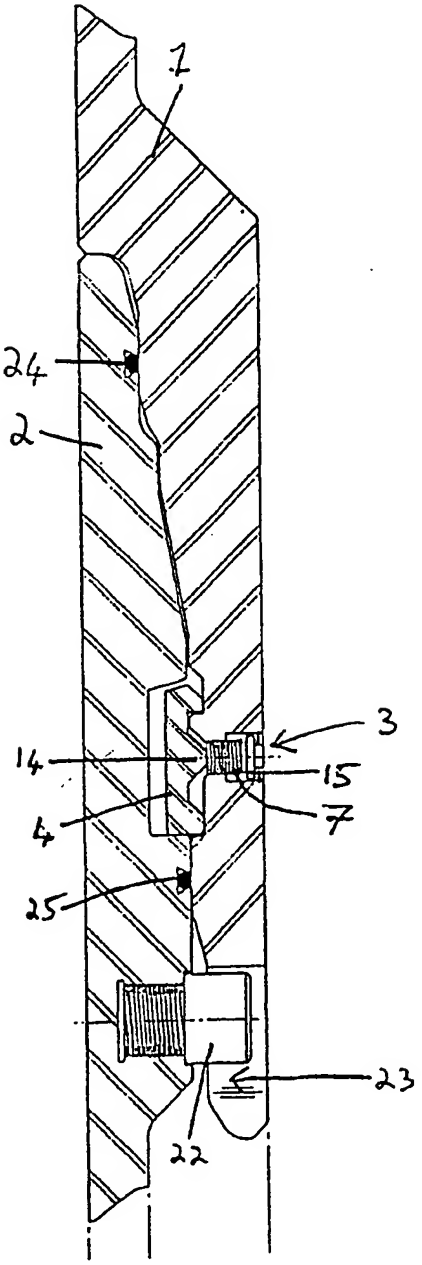

Figure 5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 30 7043

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	GB-A-2 099 945 (DRIL-QUIP. INC.) * Page 3, lines 114-130; figures 3,4 *	1,2,5,6 ,8,9	E 21 B 17/08 E 21 B 33/038 F 16 L 25/00 F 16 L 37/00
Y	GB-A-2 156 467 (VETCO OFFSHORE INC.) * Page 2, lines 21-44; figures 2,5 *	1,2,5,6 ,8,9	
A	US-A-3 455 578 (J.W.E. HANES) * Column 5, lines 62-75; figure 1 *	3,4	
A	US-A-3 297 344 (J.W.E. HANES) * Column 3, lines 1-8; figure 5 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

E 21 B
F 16 L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	09-10-1990	RAMPELMANN K.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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& : member of the same patent family, corresponding document

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